DEEP UNDERGROUND NEUTRINO EXPERIMENT

BROOKHAVEN NATIONAL LABORATORY

CRT modules

Arbin Timilsina

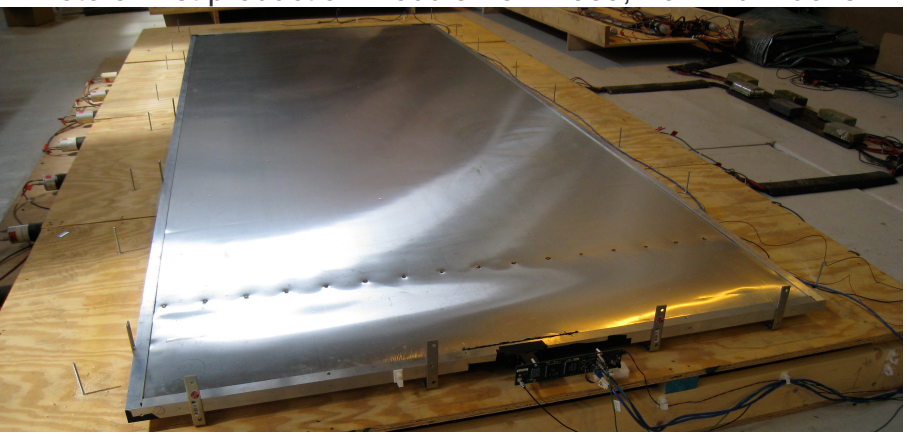
Local DUNE Meeting

June 28, 2013

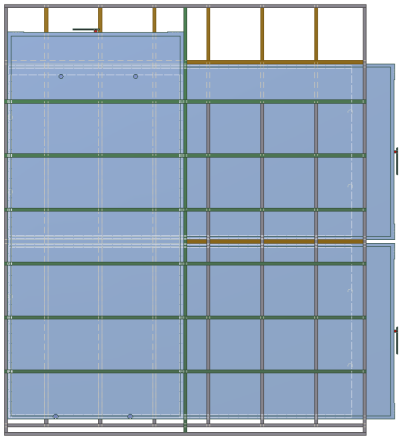
Background

- About 60 of CRT modules built for Double Chooz Outer Veto were ultimately not installed
- The plan is to use 32 of these as ProtoDUNE CRT
- ProtoDUNE CRT will be based on units of 4 modules: 2 x and 2 y modules combined to create 3.2-m x 3.2-m area with 2D readout (2.5 cm x 2.5 cm pitch)

Photo of first production module from 2009, from Ed Blucher



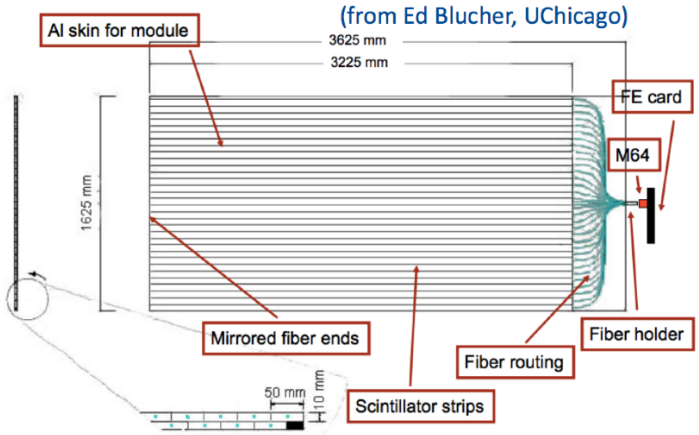
ProtoDUNE 4-module unit



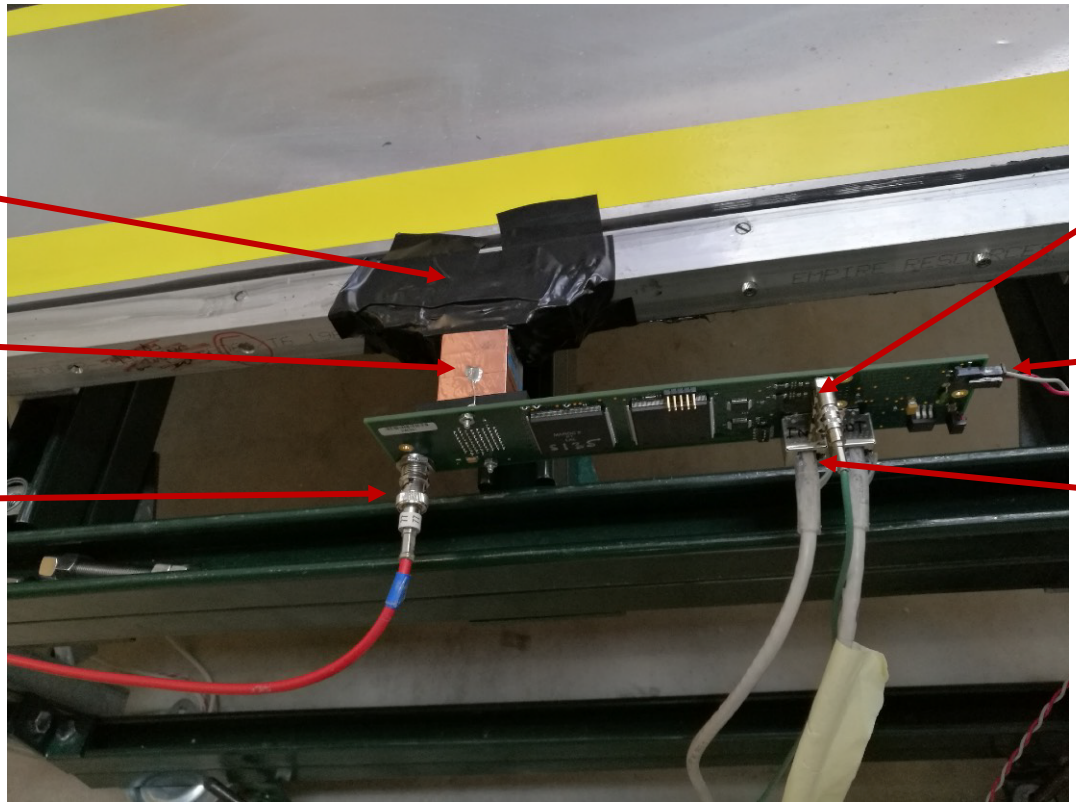
- I was at Fermilab the week of June 12 for the installation of bottom CRT modules for ICARUS (in order to learn for the ProtoDUNE installation and commissioning)
- We were able to test 10 modules and install 5 that week

Assembly

Install PMT and PMT board and connect to stand-alone LV, HV, and clock



64 fiber channels for each module



Black tape needed to insure light tightness

PMT

HV (~-800 V)

62.5 MHz clock

LV (6 V)

CAT in/out

Not shown: Aluminum box to protect the board

Test procedure

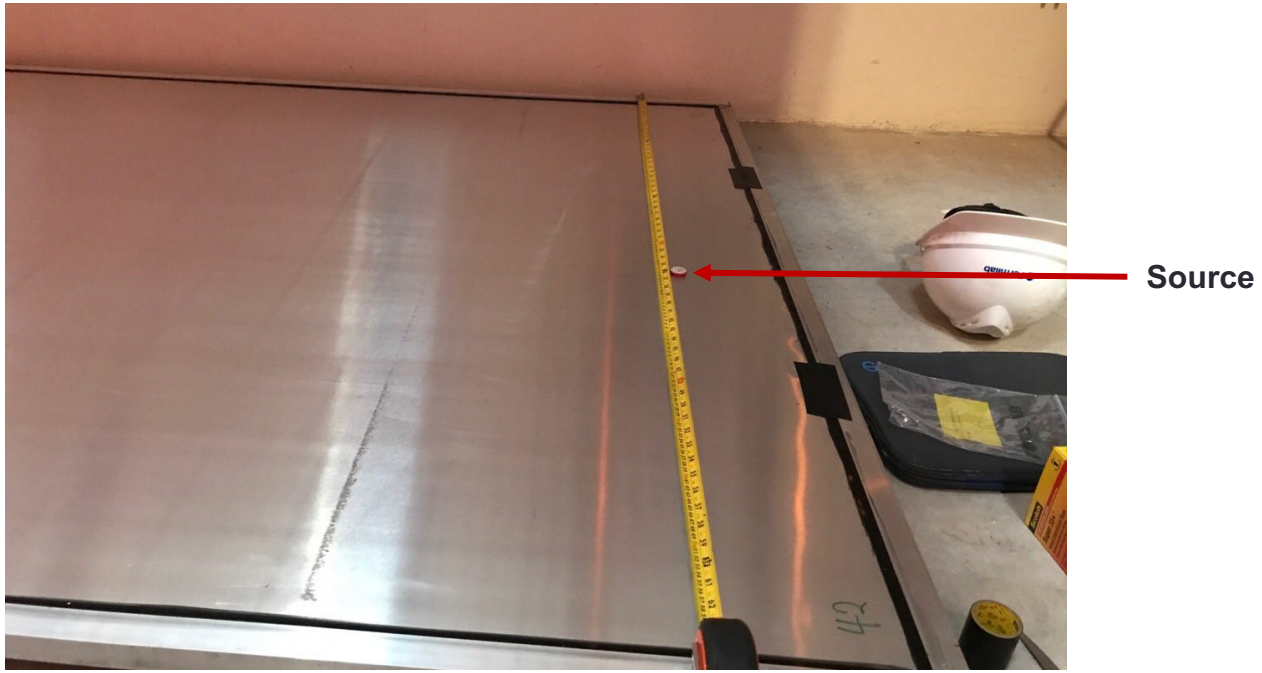
Goals:

- Make sure that PMT + board assembly works fine
- Look for light leaks around the PMT connection to the module
- Look for light leaks on the module (light leak possible on the location of rivets- apply black tape by default)
- Check the fibers along the whole length of the module using a source

Test procedure

Source testing

- Used a Cs-137 gamma source
- 8 positions equally spaced at the both end of the fibers were selected
- For different positon, checked if fibers show evidence of source signal by comparing with ‘background run’



Outlook

- All components (modules, PMTs, boards) were fully tested and characterized at production time
- All installation and QC procedure identical to those used for Double Chooz
- Software to acquire data from the HV board and to do pre-analysis was provided by Virginia Tech; along with a designated Windows laptop
- HV settings for each PMT provided by VT tests
- Pre-analysis populates various histograms (charge on individual channels, stability vs. time, stability vs. channel)
- Once detailed analysis is done, Anne and Simone have promised to provided us with plots/data so we can compare during ProtoDUNE installation and commissioning